

2. On some Remains of *Grypotherium* (*Neomylodon*) *listai* and associated Mammals from a Cavern near Consuelo Cove, Last Hope Inlet, Patagonia. By A. SMITH WOODWARD, LL.D., F.Z.S.

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(Plates V.-IX.)

Last February, when presenting to this Society an account of the skin of a Ground-Sloth discovered in a cavern in Southern Patagonia, Dr. Moreno mentioned that further excavations were being made in the hope of finding other remains of the same animal (P. Z. S. 1899, p. 148). The task referred to was undertaken by Dr. Rudolph Hauthal, geologist of the La Plata Museum, who met with complete success¹. He not only found another piece of skin, but also various broken bones of more than one individual of a large species of Ground-Sloth in a remarkably fresh state of preservation. Moreover, he discovered teeth of an extinct horse and portions of limb-bones of a large feline carnivore, in association with these remains; he likewise met with traces of fire, which clearly occurred in the same deposits as the so-called *Neomylodon*. All these remains were found beneath the dry earth on the floor of an enormous chamber which seemed to have been artificially enclosed by rude walls. In one spot they were scattered through a thick deposit of excrement of some gigantic herbivore, evidently the Ground-Sloth itself; in another spot they were associated with an extensive accumulation of cut hay. Dr. Hauthal and his colleagues, indeed, concluded that the cavern was an old corral in which the Ground-Sloths had been kept and fed by man.

As the result of these explorations, Dr. Moreno has now the gratification of exhibiting to the Society complete proof that the piece of skin described on the former occasion belongs to a genuine Pampean Ground-Sloth, not *Mylodon* itself, but a very closely related genus [*Grypotherium*], of which skulls are already known from Pampean deposits in the Province of Buenos Ayres². The collection which we now have the privilege of examining distinctly supports his contention that the large quadruped in question belongs to an extinct fauna, though contemporary with man. The

¹ R. Hauthal, S. Roth, and R. Lehmann-Nitsche, "El Mamífero Misterioso de la Patagonia, *Grypotherium domesticum*," Revista Mus. La Plata, vol. ix. pp. 409-474, pls. i.-v. (1899).—F. P. Moreno, "Note on the Discovery of *Miotania* and of *Glossotherium* (*Neomylodon*) in Patagonia," Geol. Mag. [4] vol. vi. pp. 385-388 (1899).

² J. Reinhardt, "Beskrivelse af Hovedskallen af et Kampedovendyr, *Grypotherium darwini*, fra La Plata-Landenes plejstocene Dannelser," K. Dansk. Vidensk. Selsk. Skr. [5] vol. xii. (1879), pp. 353-380, pls. i., ii.—H. Burmeister, 'Atlas de la Description physique de la République Argentine,' sect. ii. (1881), p. 119, woodc. (*Mylodon darwini*).—R. Lydekker, "The Extinct Edentates of Argentina," Anales Mus. La Plata—Paleont. Argentina, vol. iii. pt. 2 (1894), p. 85, pl. liv.

discovery is thus unique in the history of palæontology, on account of the remarkably fresh state of preservation of all the remains. Some of the new specimens exhibit no indication whatever of having been buried. Many of the bones retain their original whitish colour, apparently without any loss of gelatine; while both these and other bones, which have evidently been entombed in brownish dust, bear numerous remnants not only of the dried periosteum, but also of shrivelled muscles, ligaments, and cartilages. Very few of the bones are fossilized, in the ordinary sense of the term.

An admirable brief description of this collection has already been published (*op. cit.*) by Dr. Roth, who was the first to recognize the generic identity of *Neomyodon* with *Grypotherium*. Some of the specimens, however, are worthy of a more detailed examination; and Dr. Moreno has kindly entrusted them to me for study in connection with the collections in the British Museum and the Royal College of Surgeons. The following notes, supplementing Dr. Roth's original memoir, are the result of this further investigation.

I. REMAINS OF *GRYPOTHERIUM LISTAI*.

Number of Individuals.

Among the fragmentary bones of the Ground-Sloth, it is easy to recognize evidence of three individuals, which do not differ much in size. There are three distinct examples of the occiput (nos. 1, 2, 3), and fragments of the dentigerous portion of three mandibles. It is also noteworthy that the three malar bones preserved (no. 8) are all different in shape, while three corresponding fragments of the acromial process of the scapula differ in size. One portion of maxilla (no. 5) seems to represent a fourth individual, being probably too small for either of the skulls to which the occiputs belong. Finally, as Dr. Roth has pointed out, one shaft of a humerus (no. 22), which appears to be the bone of an adult, belongs to a much smaller animal than is indicated by any other specimen in the collection.

Remains of three individuals are thus recognizable with certainty; two others can probably be distinguished; while some of the fragments may even belong to a sixth specimen. It must also be noted that other portions of jaws are said to have been discovered by E. Nordenskjöld¹.

Skull and Mandible.

The largest portion of cranium (no. 1) is not stained in any way, and does not retain a trace of the material in which it was buried in any hollow or crevice. It is shown of nearly one-half the natural size, from the right lateral and inferior aspects, in the drawing (Pl. V. figs. 1, 1 a). It does not appear to have been damaged during

¹ R. Hauthal, *op. cit.* p. 4.

excavation, but exhibits fractures which were almost certainly made when the animal was freshly killed. The cranial roof near the occipital region is battered in four places, though the injuries do not affect the brain-case itself; while the right occipital condyle is partly removed by a sharp, clean cut. There can, indeed, be no doubt that the animal was killed and cut to pieces by man.

This skull is evidently that of an adult animal, all the sutures in the hinder region being closed. The inner wall of the temporal fossa is much flattened, without any irregular convexities, but marked with the characteristic reticulately-decussating, fine ridges of bone, and studded with adherent patches of muscle-fibre. The upper border of the fossa is a remarkably sharp edge, while the narrow flattened cranial roof is only marked by a faint longitudinal median furrow and by a diminutive tuft of fibre in a small median pit near the occipital edge¹. The fractures exhibit the very large cancellated chambers surrounding the brain-case dorso-laterally; while a median longitudinal section (Pl. V. fig. 1 b) shows both these cells and others in the basisphenoid. The basi-cranial axis is nearly straight, inclining a little upwards in front. The anterior condyloid foramina (Pl. V. fig. 1 a, f.) piercing the basioccipital are remarkably large, as usual; the basisphenoid (*b.s.*) is very long and narrow, flattened mesially on its lower face, but with one slight median prominence near its hinder end; the presphenoid (*p.s.*) forms a short acute rostrum, above which there are remains of the vomer. The hinder ends of the pterygoids (*pt.*) are shown to be inflated with large cancellæ, but the sides of the base of the skull are somewhat obscured by the dried soft parts. The mastoid process of the petiotic, with its articular facette (*m.*) for the stylohyal, seems to be rather smaller than in *Mylodon*. The tympanic bone (*t.*) is preserved on the right side, though wanting on the left. It is an irregular curved plate only slightly bullate, but forming a complete floor to the tympanic cavity. As usual in Edentata, it is not produced into an auditory meatus.

The right maxilla (no. 4) is in precisely the same state of preservation as the specimen just described, and probably belongs to the same skull. It is shown of nearly one-half the natural size, from the outer aspect, in the drawing (Pl. V. fig. 2). Its anterior margin is perfectly preserved, indicating that the facial region is very short in front of the anterior end of the zygomatic arch, which is pierced by a rather large suborbital canal. Its upper border proves that the nasal region was raised into a slightly convex dome; while its antero-superior angle is not rounded as in *Mylodon*, but curves upwards and forwards and ends in a point as in *Grypotherium*. At the oral border there are the shattered bases of four teeth.

The fragment of the nasal region (no. 13), shown of nearly one-half the natural size, from the right lateral and anterior aspects, in the drawing (Pl. V. figs. 3, 3 a), may also have belonged to the same

¹ See S. Roth, *op. cit.*, pl. ii. fig. 1.

skull, but its state of preservation is a little different from that of the two specimens just described. It has clearly been buried in a powdery deposit, which has stained it brown; but the enveloping dust must have been extremely dry, for fragments of cartilage adhere to it, as well preserved as in the nasal chamber of the cranium itself (no. 1). It also bears traces of the integument.

Judging by the figures of the skull of *Grypotherium* published by Reinhardt (*loc. cit.*), this specimen seems to have occupied the anterior position in the nasal region represented in Pl. V. fig. 3. It is thus of great interest, because the three known skulls of *Grypotherium* leave the precise nature of the bony arcade separating the narial openings undecided. According to Reinhardt, the nasal bones terminate as in *Myiodon*, and the arcade is an element interposed between them and the premaxillæ. According to Burmeister, the nasals themselves extend forwards and constitute the greater part, if not the whole, of the problematical bar. The fragment now under consideration is clearly in favour of the latter interpretation. Its lower thickened end (*a*) is a massive bone, not bilaterally symmetrical, and not showing any trace of a median suture. Its inferior face is irregular and roughened, and can scarcely be regarded as an articular facette. Its upper portion consists of a pair of bones (*na.*), separated by a very well-marked median longitudinal suture. These are not thickened at their contracted upper end, where they have evidently been broken, and are not quite bilaterally symmetrical. They doubtless fuse at their lower end with the problematical azygous bone already mentioned, but the arrangement is obscured by the enveloping soft parts. A pair of bones, which may be regarded as nasals, thus extend forwards in a narrow arch to a point just above the anterior end of the premaxillæ; while the massive bone effecting a union between the two normal pairs of elements is probably an ossification in the internasal septum. It is interesting to note that there is an incipient trace of a similar forward production of the nasals in the genus *Scelidothorium*; while there is sometimes an ossification of the internasal septum in *Megatherium*¹.

The three specimens now described, when placed approximately in their natural positions, as in the drawing (Pl. V. figs. 1-3), afford a very satisfactory idea of the form and proportions of the skull when complete. The malar bone is the only important part to be added; but unfortunately it is impossible to decide which of the three specimens of this element in the collection belongs to the individual now under consideration. As already mentioned, these three bones are all different in the shape and proportions of the hinder bifurcated end. They are all very fresh in appearance, but have been stained reddish brown by the earth in which they must have been buried. The best example, from the right side, is shown of one-half the natural size in the drawing (Pl. VI. fig. 1). One

¹ R. Lydekker, *Anales Mus. La Plata—Paleont. Argentina*, vol. iii. pt. 2 (1894), p. 73, pl. xlv. fig. 1.

of the other specimens is less deep at its hinder fork and has a more slender descending process.

The hinder portion of the second skull already mentioned (no. 2) comprises the occiput and brain-case as far forward as the front of the cerebral hemispheres. It is much battered and broken, and in quite as fresh a state as the cranium already described, with a considerable investment of dried soft parts on its base. It is only very slightly smaller than no. 1, but is of interest as exhibiting some of the sutures, besides a roundness and smoothness indicative of immaturity. The supraoccipital is shown to be very large; a small median point of it enters the foramen magnum, while the suture separating it from the parietals and squamosals extends along the rounded lambdoidal ridge. The horizontally-extended suture between the squamosal and parietal on the inner wall of the temporal fossa is seen in the position where Owen determined it to occur in *Myiodon*¹. Both tympanics are preserved, but they are more obscured by soft parts than in no. 1.

To this cranium probably belongs a detached portion of the left side of the facial region (no. 5), in a similar state of preservation and slightly smaller than the maxilla no. 4 (Pl. V. fig. 2). The suture between the frontal and the maxilla still persists, while the oral border is preserved further forward than in the last-mentioned specimen, showing a fragment of the much-reduced premaxilla united with the maxilla by a jagged suture.

The third imperfect occiput, comprised among the fragments numbered 3, is about as large as the immature specimen no. 2, but does not exhibit any features worthy of special note.

The largest and most important portions of the mandible are nos. 9 and 11, which evidently belong to the right and left rami of one and the same jaw. They are much broken and are in the same fresh condition as the skulls, with traces of the periosteum and even considerable portions of the soft parts of the gum. The right ramus (Pl. VI. fig. 2) is preserved sufficiently far forwards to show that there was no caniniform tooth in front of the series of four ordinary molars. Judging by the extent of the latter series, the specimen probably belongs to the same individual as the skull no. 1.

Another portion of a mandibular ramus (no. 10) of the left side is slightly smaller than the last and may well have belonged to the immature individual no. 2. It is similarly quite fresh in appearance, and bears the shrivelled remains of the gum. It is interesting as exhibiting the two posterior molars slightly different in shape from those of the former mandible. In this specimen (Pl. VI. fig. 3) the longer axis of the third molar is oblique, whereas in no. 9 (Plate VI. fig. 2*a*) it is coincident with the axis of the mandible; while in the former the fourth molar is not so long in proportion to its width as in the latter. Such slight differences,

¹ R. Owen, 'Description of the Skeleton of an Extinct Gigantic Sloth, *Myiodon robustus*, Owen' (1842), p. 18.

however, cannot be regarded in the Edentata as more than individual variations.

Brain-cavity and Cerebral Nerves.

By the kind permission of Dr. Moreno, the cranium no. 1 has been vertically bisected to display the character of the cranial cavity and the nerve-foramina. An instructive plaster cast of the cavity (shown of one-half the natural size in Pl. VII.) has thus been made by Mr. C. Barlow, the Formatore of the British Museum.

The olfactory lobes (*ol.*) are shown to have been well-developed, projecting a little in front of the cerebral hemispheres (*c.*). These hemispheres are together somewhat longer than broad, slightly broader behind than in front, and a little constricted in the middle. They do not overlap the cerebellum (*cb.*), which is relatively large. The origins of the nerves (fig. 1 *b*) are very imperfectly shown in the cast; only their exits from the cranial cavity are clear. The most interesting are the optic (II.) and trigeminal (V.) nerves, which pass out of the cranial cavity at first by a common exit, which is soon subdivided by a bony partition into two canals, the former no less than 0.08 m., the latter 0.045 m. in length. The fourth (IV.), seventh (VII.), eighth (VIII.), and twelfth (XII.) nerves are also recognizable on the cast; and one prominence of plaster (*f.*) has filled the foramen lacerum posterius.

Compared with the brains of *Myiodon* and *Scelidotherium*, so far as known from casts of the cranial cavity¹, that of *Grypotherium* is observed to be more elongated, with less divergent and prominent olfactory lobes, less constricted cerebral hemispheres, and a larger cerebellum. In the form and proportions of the cerebrum and cerebellum, it similarly differs from *Megatherium*². The cerebral hemispheres of the existing *Choloepus didactylus* and *Bradypus tridactylus*³ are more tapering forward, and their cerebellum is relatively smaller than in *Grypotherium*.

Auditory Ossicles.

The auditory ossicles were preserved in the tympanic cavities of both skulls, nos. 1 and 2, being retained by the dried soft parts. They were detected by Prof. Charles Stewart, who kindly extracted them, with great skill, from both sides of each skull. The series of the right side of the first specimen is shown of twice the natural size in the drawing (Pl. VI. fig. 4). Comparing these ossicles with the fine collection in the Royal College of Surgeons, they prove to be closely similar to those of all the existing Sloths, but most nearly resembling those of *Choloepus didactylus*. The malleus (*m.*) is bent exactly as in the latter species, and is of similar shape. As observed by Prof. Stewart, it is remarkable in articulating with the incus not

¹ P. Gervais, "Mémoire sur les Formes Cérébrales propres aux Édentés vivants et fossiles," *Nouv. Arch. Mus.* vol. xv. (1869), p. 39, pl. iv. figs. 1, 2.

² P. Gervais, *loc. cit.* p. 39, pl. v.

³ P. Gervais, *loc. cit.* p. 38, pl. iv. figs. 3, 4.

only by the head, but also by a diminutive lower facette, which is in contact with a small faceted process (*x*) on the anterior arm of the incus. A feeble indication of the same secondary articulation is also observable in *Cholæpus*; but it is curiously absent in the second specimen of *Gryppotherium*. The two divergent arms of the incus (*i.*) are equal in length, as usual in the Sloths. The stapes (*s.*) is only very slightly perforated in both specimens; while a small circular disc firmly fixed to the incus represents the orbicular bone in the second skull. The auditory ossicles of *Gryppotherium*, therefore, are very different from those of *Myrmecophaga*, in which the malleus is less sharply bent, the incus has divergent arms of unequal length, and the stapes exhibits a large perforation¹.

Vertebræ and Limb-bones.

Nearly all the remains of vertebræ and limb-bones are in the same state of preservation as the portions of skull and mandible already described, with adherent cartilage and traces of muscles and ligaments. With some of the ungual phalanges there are also well-preserved examples of the epidermal sheath. The best of the latter, probably belonging to the fourth digit of the manus, is shown of two-thirds the natural size in the drawing (Pl. IX. figs. 1, 1*a*). As already remarked by Roth, its edges are quite sharp, and indicate that if the animal walked on its fore feet it resembled *Myrmecophaga* in the peculiar twist of the manus.

All the specimens in this series seem to have been accurately determined and sufficiently described by Roth. It is only necessary to emphasize the fact that the two shafts of humerus with abraded, not sharply-broken, ends have a much more fossilized appearance than any other specimen in the collection, and are deeply stained throughout by ferruginous matter. The small shaft, no. 22, certainly seems to have belonged to an adult animal, as remarked by Roth, and it was probably much smaller than any individual indicated by the other remains.

Skin and Hair.

The new piece of skin, which is stated by Hauthal to have been found in the deposit of excrement, is not quite so well preserved as the original piece. It is much folded in an irregular manner; and the hair, which is yellower than in the previous specimen, is preserved only in patches on the outer face. It must have been stripped from the body of the animal by man; but the only distinct marks of tools, which were evidently made when the skin was fresh, are a few indents and small pits on the outer face. The indents must have been made by oblique thrusts of a stick, or a small, blunt, chisel-shaped instrument, and are well shown in Roth's photograph (*loc. cit.*) on the portion marked *d*, *e*. The small pittings are

¹ J. Hyrtl, 'Vergleichend-anatomische Untersuchungen über das innere Gehörorgan des Menschen und der Säugethiere' (1845), p. 135, pl. v. fig. 6.

nearer the middle of the specimen and less conspicuous. A vacuity in the skin seems to be due to accidental tearing or to a thrust after it was dry: it may even have been caused by the fallen blocks of stone found lying upon it.

The specimen, as preserved, measures about a metre across in one direction by 93 centimetres in another direction. As already observed by Roth, its irregular folding makes the determination of its position on the trunk very difficult; but I am convinced that its state of preservation is not sufficiently good to justify an attempt to unfold the skin by the ordinary method of steaming. Taking all facts into consideration, Roth seems to be correct in ascribing it to the right flank and the postero-superior part of one of the limbs. It most probably belongs to the fore limb, as Roth supposes; but there is no clear proof that it is not referable to the hind-quarters. The direction of the comparatively short hair of the flank determines the anterior and posterior borders of the specimen to be those respectively marked *f, b, g, i* and *e, d, h, k* in Roth's photograph. The border marked *f, a, e* is thus directly antero-posterior, parallel with the median longitudinal line of the back; while the piece bounded by the letters *g, i, c, k, h*, with comparatively long hair, which is inclined chiefly towards a median vertical line, but also slightly downwards, can only be referred to the posterior face of a limb.

The original situation of the piece of skin being thus determined, it is interesting to observe the disposition of the ossicles in the lower layer. Owing to abrasion, contraction, and partial disintegration, they are conspicuous in most parts of the specimen. They are very irregular in shape and size, and closely compacted together, as in the previous specimen. It is, however, to be noted that in some parts (Pl. VIII. fig. 1) there is a distinct tendency to arrangement in regular, straight, parallel rows. The long axes of the elongated ossicles are nearly always coincident with the direction of these rows. They are especially well shown on the middle of the flank, from which the drawing is taken; and, as might be expected, the rows are here disposed vertically, parallel with the ribs.

In some parts of the skin the ossicles are exposed on their outer face; but appearances render it almost certain that this exposure is due to the disintegration and abrasion of the specimen. In one patch (Pl. VIII. fig. 2) thus uncovered by the removal of the soft parts, the ossicles are seen to form a closely-arranged, flattened pavement; and their outer face is much more conspicuously marked by pittings than that of any ossicle extracted from the first discovered piece of skin. In fact, as Roth remarks, the pitting is here quite similar to that observable on many ossicles dug up in association with the fossil skeletons of *Myiodon*; though it does not form so regular a reticulate pattern as that of the dermal ossicles of *Myiodon* in the British Museum figured on the former occasion¹.

¹ P. Z. S. 1899, pl. xv. figs. 4-6.

Another interesting feature of the new piece of skin consists in the dwindling and even total absence of the ossicles towards the ventral border. A section along the edge marked *d* in Roth's photograph exhibits only two diminutive nodules of bone in a length of 0.1 m.; while another similar section taken vertically from the skin of the limb near *k* shows no trace of ossicles, except perhaps two little specks. It must, however, be noted that the limb was not entirely destitute of armour; for on the border marked *g*, *i*, the bones are as well developed and conspicuous as on the middle of the flank. In the newly-cut sections the skin has a translucent aspect, showing that it is merely dried and not tanned in any way.

The hair on the new specimen varies in length from 0.07 m. or 0.10 m. at *b* to 0.15 m. or 0.22 m. on the limb. It is thus longer than that of the previous piece of skin. Masses of still longer hairs—some 0.30 m. in length—were found detached among the excrement, and these are also believed by Roth to belong to the same animal. His determination is probably correct; for, when examined microscopically, these long hairs are observed to have a perfectly smooth cuticle, while some transverse sections (kindly made by Mr. R. H. Burne) demonstrate the complete absence of a medulla, exactly as in the short hairs. The latter feature proves that they cannot be referred either to the horse or to the guanaco.

Excrement.

The large cylindrical pieces of excrement, which may be referred to *Grypotherium* without any hesitation, have already been described and figured by Dr. Roth. They consist of irregular discoids of herbaceous matter closely pressed together, the largest measuring no less than 0.18 m. in diameter. Mr. Spencer Moore has kindly examined them from the botanist's point of view and reports that they are composed "in large part apparently of grasses, as the haulms, leaf-sheaths, fragments of leaves, &c. of these plants are frequent in the mass. A spikelet, almost entire, of what seems to be a species of *Poa*, and the flowering glume of another grass, probably avenaceous, have also been found. Besides these there are at least two dicotyledonous plants, one herbaceous and the other almost certainly so, the latter having a slender greatly sclerotized stem. Unfortunately, as no leaves have hitherto been observed attached to the fragments of stem, their affinities are altogether doubtful. There are numerous siliceous particles in the excrement, and there are many pieces of the underground parts of the plants, suggesting that they have been pulled out of the ground. A few pieces of stems are sharply cut, not bruised or torn at the end." The latter fact is especially important in connection with Dr. Hauthal's discovery of cut hay in the cavern, and his theory that the *Grypotherium* was kept in captivity and fed by man.

Generic and Specific Determination.

The fortunate discovery of all parts of the skull and dentition renders the generic determination of this Ground-Sloth now quite certain. The teeth show that it belongs to the family Mylodontidæ; the presence of only four instead of five upper molars separates it from the genera *Myodon*, *Lestodon*, and *Scelidotherium*; the forward production of the nasals and the ossification of part of the internarial septum place it definitely in the allied genus *Grypotherium*, as originally diagnosed by Reinhardt. The only question needing consideration is, whether the fragment of cranium described by Owen in 1840 as the type of the genus *Glossotherium*¹ is really identical with that subsequently described by Reinhardt under the name of *Grypotherium darwini*, as now seems to be commonly believed.

Darwin's original specimen, on which the genus *Glossotherium* of Owen was founded, is preserved in the Museum of the Royal College of Surgeons. It has thus been possible to compare it directly with the undoubted cranium of *Grypotherium* from the Patagonian cavern. The specimen is merely the left half of the hinder part of the cranium, and is therefore very inadequate for discussion; but several features seem worthy of note. Compared with the new skull no. 1, the fragment named *Glossotherium* has (i.) the inner wall of the temporal fossa less flattened, (ii.) the digastric fossa deeper in proportion to its width, (iii.) the hinder border of the inflated pterygoid vertical, instead of sloping downwards and forwards, (iv.) a much larger and deeper pit for the articulation of the stylohyal, and (v.) a longer canal penetrating the base of the occipital condyle for the passage of the hypoglossal nerve. In all these respects the so-called *Glossotherium* agrees much more closely with the typical *Myodon*; and Owen was probably correct in 1842 when he expressed the opinion that the two are at least generically identical².

I am therefore of opinion that *Grypotherium* is the correct generic name for the Ground-Sloth from the Patagonian cavern, while *Glossotherium* must be relegated to the synonymy of *Myodon*.

The specific determination of the new specimens is more difficult. As remarked by Roth, only two species of *Grypotherium* seem to be already known from the Pampa formation—*G. darwini* by three skulls³ and *G. bonaerense* solely by a maxilla⁴. The portions of skull and dentition now under discussion indicate an animal much larger than *G. bonaerense* (assuming the original maxilla to be that of an adult); while they are considerably

¹ R. Owen, 'The Zoology of the Voyage of H.M.S. Beagle.—Part I. Fossil Mammalia' (1840), p. 57, pl. xvi.

² R. Owen, 'Description of the Skeleton of an Extinct Gigantic Sloth, *Myodon robustus*, Owen' (1842), p. 154, footnote.

³ Described respectively by Reinhardt, Burmeister, and Lydekker, *loc. cit.*

⁴ F. Ameghino, 'Contribucion al Conocimiento de los Mamíferos de la Republica Argentina' (1889), p. 738, pl. xlv. fig. 8.

smaller than any known specimen of *G. darwini*. Moreover, the nasal arcade now described is narrower and more concave on its outer face than that of *G. darwini*, as already observed by Roth. It thus seems very probable that the animal from the Patagonian cavern represents a distinct species, which must bear the name of *G. listai*. This specific name was given by Ameghino to a fragment of the first-discovered piece of skin, and the curious argument which leads Roth to propose the substitution of a new name for it does not affect its validity.

It may be added that Dr. Erland Nordenskjöld has recently compared his specimens from the Patagonian cavern with the skull of *Grypotherium darwini* at Copenhagen, and finds no specific difference¹. No particulars, however, have yet been published.

II. ASSOCIATED MAMMALIAN REMAINS.

Felis, sp.

A feline carnivore larger than the existing Jaguar (*Felis onça*), but about the same size as an average Tiger (*F. tigris*), is represented in the collection by the distal half of a right humerus (no. 44), a left fourth metatarsal (no. 46), and the distal end of another metatarsal (no. 47). These bones have evidently been buried in dust, but are in the same fresh state of preservation as those of *Grypotherium*. They have been well described by Roth, but the new figures of the humerus here given (Pl. IX. figs. 2, 2a) will serve to illustrate his description better than the reduced photograph already published.

Careful comparison of these bones shows that they are undoubtedly feline; and there is no difficulty in determining that they belong to *Felis* rather than to the extinct *Machærodus*. A humerus of *M. neogæus*, from a Brazilian cavern, now in the British Museum (no. 18972b), is readily distinguished from the new Patagonian humerus by the remarkable lateral compression of its shaft and the much greater downward extension of its prominent and sharp deltoid ridge. The humerus in all the large species of *Felis*, on the other hand, only differs from the fossil now under discussion in very small particulars. In fact, the humerus and metatarsals of the existing *Felis onça* are essentially identical with the bones from the Patagonian cavern, except that they are rather smaller. I am therefore inclined to regard the newly-discovered remains as indicating a comparatively large variety of *F. onça*, which once lived in the temperate regions of Patagonia, beyond the present range of this species. Such an occurrence would be a precise parallel to that of the Cave-Lion in Europe. It is well-known that nearly all the remains of *Felis leo* found in

¹ E. Nordenskjöld, "La Grotte du *Glossotherium* (*Neomyiodon*) en Patagonie," *Comptes Rendus*, vol. cxxix. (1899), p. 1217.

the Pleistocene formations of the temperate parts of the Old World indicate animals of somewhat larger size than any surviving in the warmer regions to which the species is now confined¹.

It may be noted that bones of the Jaguar of ordinary dimensions have been recorded from the Pampa formation of the Province of Buenos Ayres².

Arctotherium, sp.

With the bones of *Felis* just noticed, Roth provisionally associates the imperfect distal end of a remarkably large right femur (no. 45). He is thus induced to suppose that the carnivore represented by the fragments will prove to be a new genus and species of the Felidæ. He suggests for it the name of *Iemisch listai*, on the assumption that it is the mysterious quadruped which Ameghino states is known to the natives as the Iemisch.

A comparison of the distal end of femur in question with the femora of Felidæ in the British Museum seems to prove conclusively that it cannot be referred even to the same family. Its width across the condyles is much greater, compared with its antero-posterior diameter, than that observed in any feline. Moreover, the pit for the tendon of the popliteus muscle below the external condyle is unusually deep. In both these respects the bone closely resembles the distal end of the femur of a Bear. I have been therefore led to compare it with the corresponding part of the extinct Bear of the Pampean formation, *Arctotherium*.

Fortunately, the fine and nearly complete skeleton of *Arctotherium bonaerense* in the Bravard Collection in the British Museum comprises the right femur and enables direct comparison to be made. The fragment (Pl. IX. figs. 3, 3a) lacks the inner condyle; but enough of the trochlea remains to show its broad and gently-rounded form, with a wide and deep intertrochlear notch, precisely as in *Arctotherium*. It has the same development of the external condyle as in the latter, while the fossa for the popliteal tendon is equally deep, only slightly differing in shape. In fact, there is very little discrepancy, except in its smaller size; and species of *Arctotherium* smaller than *A. bonaerense* are already known both from the Pampa formation of Argentina³ and the caverns of Brazil⁴.

The fragment just described has evidently been severed from the rest of the bone by a sharp, clean cut made by man; and Dr. Hauthal is quite certain that this was not done by one of his workmen during excavation (*op. cit.* p. 59). At least one medium-

¹ Dawkins & Sanford, "The British Pleistocene Mammalia" (Palæont. Soc. 1869), p. 150.

² F. Ameghino, 'Contribucion al Conocimiento de los Mamíferos de la Republica Argentina' (1889), p. 342.

³ F. Ameghino, *op. cit.* (1889), p. 317.

⁴ H. Winge, "Jordfundne og nulevende Rovdyr (Carnivora) fra Lagon Santa, Minas Geraes, Brasilien" (E Museo Lundii, 1895), p. 31.

sized species of *Arctotherium* must therefore have survived until the human period in Southern Patagonia¹.

Onohippidium saldiassi.

A horse is represented in the collection by an upper molar (no. 55), a fragment of premaxilla with two incisors (no. 56), an imperfect atlas (no. 57), and two well-preserved hoofs apparently of a fœtus or perhaps of a newly-born animal (no. 58). Of these remains only the upper molar is capable of satisfactory determination.

This tooth is the second upper molar of the left side, and has been exhaustively compared with corresponding teeth by Dr. Roth, who gives a good series of figures. It is readily distinguished from the homologous molar in the genus *Equus* by the peculiar form of its two inner columns—a fact which I have been able to verify by the examination of an extensive series of specimens, both recent and fossil, in the British Museum. Further comparison, indeed, shows that it must be referred to the extinct Pampean genus *Onohippidium*². Dr. Roth assigns it, apparently quite rightly, to the same species as a maxilla from the Pampean formation of the Province of Buenos Ayres, for which he proposes the name of *Onohippidium saldiassi*.

Large Extinct Rodent.

The proximal end of the femur of a large rodent (no. 52) has already been recognized by Roth, and compared with the extinct *Megamys*. It cannot be more exactly determined.

Existing Species.

One imperfect fragment of pelvis and sacrum (no. 48) seems to belong to a puma (*Felis concolor*) of rather large size; but it is not sufficient for precise determination.

The small mandibular ramus of a musteline (no. 51) referred by Dr. Roth to *Mephitis suffocans* does not pertain to this genus and species. Mr. Oldfield Thomas determines it to belong to the rare *Lyncodon patagonicus*, which still lives in Patagonia and has not hitherto been found fossil. A slightly larger extinct species of the same genus has been described by Ameghino on the evidence of a skull from the Pampean formation near Luján, in the Province of Buenos Ayres³.

A cranium, some vertebræ, and a tibia and fibula (nos. 53, 54) appear to represent the existing *Ctenomys magellanicus*, as noted by Roth.

¹ Dr. Moreno has lately received reports of bear-like tracks in remote parts of the Cordillera, which he thinks may imply that a species of *Arctotherium* still lives in Patagonia.

² F. P. Moreno, *Revista Mus. La Plata*, vol. ii. (1891), p. 65; R. Lydekker, *Anales Mus. La Plata—Paleont. Argentina*, vol. ii. pt. 3 (1893), p. 77, pl. xxix.

³ F. Ameghino, *op. cit.* (1889), p. 324.

The remains of the Guanaco (*Lama huanacos*) do not present any features worthy of special remark.

Man is represented by a diseased scapula (no. 111), and by two bone awls (nos. 49, 50), which are clearly made from the tibia of a species of *Canis* intermediate in size between *C. jubatus* and *C. magellanicus*.

III. RELATIVE AGE OF THE REMAINS.

As the result of Dr. Roth's researches, supplemented by the additional observations now recorded, it is evident that the majority of the mammalian remains from the cavern near Last Hope Inlet belong to the extinct fauna which occurs in the Pampean formation of more northern regions. To this category are referable the genera *Grypotherium*, *Onohippidium*, *Megamys*, and *Arctotherium*; also *Macrauchenia*, which is said to have been discovered in the same deposit on the floor of the cave by Dr. E. Nordenskjöld. The large *Felis* likewise probably belongs to the same series. Remains of mammals of the existing fauna, on the other hand, are comparatively few and insignificant, referable to the genera *Ctenomys*, *Cervus*, *Lama*, *Lynxodon*, and *Felis*.

Although Dr. Hauthal's explorations were rather hurried and Dr. Nordenskjöld's results have only been published hitherto in abstract¹, their account of the deposits on the floor of the cavern seem to confirm the suspicion that the remains of these two faunas were introduced at two successive periods. According to Hauthal, the remains of the Guanaco were found along with fragmentary bones of Deer, shells of *Mytilus chorus*, branches of trees, and dried leaves, in the superficial dust of the cavern near the outer wall. The skin of *Grypotherium* and all the other remains of this and the associated Pampean genera were discovered in the deeper layer of excrement and cut hay between the mound and the inner wall of the cavern. According to Nordenskjöld, three distinct strata can be recognized on the floor of the cavern as follows:—

- A. A thin surface layer, containing ashes, shells, and bones of recent animals broken by man.
- B. A middle layer, containing numerous branches of trees and dried leaves, with remains of *Lama* and the extinct horse, *Onohippidium*. Said to be probably the stratum in which the original piece of skin was found.
- C. A bottom layer, usually about a metre in thickness, without any traces of branches or leaves, but only dried herbs. Remains of *Grypotherium* numerous and confined to this stratum, associated with its excrement and hair, also with remains of a large variety of *Felis onça*, *Macrauchenia*, and *Onohippidium*.

It is unfortunate that the question of the contemporaneity of the various bones cannot be tested by the ingenious method of chemical analysis which has been applied with success to similar problems by M. Adolphe Carnot in France. The French chemist

¹ E. Nordenskjöld, "La Grotte du *Glossotherium* (*Neomyiodon*) en Patagonie," *Comptes Rendus*, vol. **cxix**. (1899), pp. 1216, 1217.

has shown that when bones are buried in ordinary sediments they undergo changes which gradually cause the percentage of contained fluorine to increase. According to him, the longer a bone has been buried, the greater is the percentage of fluorine found in it on analysis. In one case¹ he examined the scapula of a deer and a human tibia, discovered together in fluviatile sand near Billancourt (Seine); he found that the former had 7 or 8 times its usual percentage of fluorine, while the human bone did not differ in any respect from the normal in this constituent. He therefore concluded that the latter bone was not of the same age as the former, but had been introduced comparatively recently by burial. In this and the other recorded cases, however, it is to be observed that the sediment was of a uniform character and admitted of free percolation of water. In the Patagonian cavern, on the contrary, the bones occur partly in dust, partly in dried herbage, partly in dried excrement, and partly in the burnt residue of the same. Moreover, they must always have been subjected to intense dryness, and the usual process of chemical alteration cannot have taken place.

Considering all circumstances, I think that, even without chemical evidence, zoologists and geologists cannot fail now to agree with Dr. Moreno and his colleagues of the La Plata Museum, that the remarkably preserved *Grypotherium* from the Patagonian cavern belongs to the extinct Pampean fauna of South America and need not be searched for in the unexplored wilds of that continent. If we accept the confirmatory evidence afforded by Mr. Spencer Moore, we can also hardly refuse to believe that this great Ground-Sloth was actually kept and fed by an early race of man.

EXPLANATION OF THE PLATES.

PLATE V.

- Fig. 1. *Grypotherium listai*; hinder portion of cranium, right lateral and inferior (1 *a*) aspects, and in median longitudinal section (1 *b*), nearly one-half nat. size. *b.s.*, basisphenoid; *f.*, anterior condyloid foramen; *m.*, facette for stylohyal; *p.s.*, presphenoid; *pt.*, pterygoid; *t.*, tympanic.
2. Ditto; portion of right facial region, nearly one-half nat. size.
3. Ditto; anterior portion of nasal arcade, right lateral and anterior (3 *a*) aspects, nearly one-half nat. size. *na.*, nasal bones; *x*, ossification in internasal septum.

PLATE VI.

- Fig. 1. *Grypotherium listai*; right malar bone, outer aspect, one-half nat. size.
2. Ditto; portion of right mandibular ramus, inner aspect, and dentition of left ramus, oral aspect (2 *a*), one-half nat. size.
3. Ditto; dentition of another left mandibular ramus, oral aspect, one-half nat. size.
4. Ditto; auditory ossicles of right side of skull no. 1, twice nat. size. *i.*, incus, inside view; *m.*, malleus, outside view; *s.*, stapes, outside view; *x*, facette.
- 4 *a*. Ditto; incus of left side of skull no. 2, inside view, twice nat. size, showing orbicular bone (*o.*) attached.

¹ A. Carnot, "Sur une Application de l'Analyse chimique pour fixer l'Age d'Ossements humains préhistoriques," *Comptes Rendus*, vol. cxv. (1892), pp. 337-339.